



ROLE OF SOIL MICROORGANISMS IN NUTRIENT CYCLING AND IMPROVEMENT OF SOIL FERTILITY - A REVIEW

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ABSTRACT

Soil is very rich source of microorganisms such as Bacteria, Fungi, Algae, Protozoa. Soil Microorganisms play a very important role in nutrient recycling such as Carbon, Nitrogen, Phosphorus, Potassium etc. In this review the role of soil Microorganisms in making the nutrients available to plants is discussed. Other roles of soil Microorganisms include Organic matter decomposition and formation of Humus.

KEY WORDS: Microorganism, Nutrients, Bacteria, Fungi, Nitrogen, Phosphorous, Potassium, Humus.

INTRODUCTION:

Soil Microorganisms play a very important role in nutrient Cycling in the Nature. Plants require important nutrients like Carbon, Nitrogen, Phosphorus, Potassium etc (3). Soil Microorganisms especially the Bacteria and Fungi are very important in cycles of Nutrients (2). This is a very important for Plant Growth and in turn influences the agricultural productivity. There are several Mechanisms by Microorganisms make vital nutrients available to plants, but also that they improve the soil condition by contributing to Humus formation (6).

NITROGEN CYCLE:

Although earth's atmosphere contains 79% Nitrogen (N₂), still it cannot be utilized by the living organisms. It has to be converted to utilizable forms by soil Microorganisms, therefore soil Microorganisms convert Nitrogen (N₂) to utilizable form by Nitrogen Fixation. This is by symbiotic and non symbiotic means. Symbiotic Nitrogen fixation is done by Bacteria in symbiotic association with leguminous plants. Ex: Rhizobium Bacteria form symbiotic association with legumes and form nodules. Nodules are seat of Nitrogen fixation. There are several species of Rhizobium Bacteria-Rhizobium melilotii, Rhizobium leguminosarum, Rhizobium Trifolii, Bradyrhizobium haponcium etc. The leguminous plants include-Groundnut, Peas, Soyabean, Chick Pea, Alfalfa, Cloves etc. (7) In addition to these Microorganisms, Blue Green algae such as Nostoc, Anabaena, Oscillatoria, Cylindrospermum fix Nitrogen by association with rice plants. This has contributed to significant increase in the yield of Rice by 40%. The free living N₂ fixing Bacteria, such as Azotobacter, Azospirillum contribute significantly to soil Nitrogen. These Bacteria have contributed to increase in yield of Rice, Wheat, Maize, Sorghum, etc (4). The Nitrogen fixation is because of the Nitrogenase enzyme of the Nitrogen fixing Microorganisms. In addition to these group of Bacteria, the Nitrifying Bacteria such as Nitrosomonas, Nitrobacter are responsible for making Nitrogen available to plants in the form of Nitrate (NO₃⁻). And the denitrifiers are helpful in recycling of Nitrogen back to the atmosphere.

Phosphorus cycle:

Phosphorus is an essential Macronutrient required by plants. In this respect Phosphate solubilising Microorganisms such as Bacteria – Pseudomonas, Bacillus sp., and Fungi such as Aspergillus, Penicillium, Curvularia, play a very important role in making the Phosphorus available to plants. Phosphate solubilising Microorganisms (PSM) convert Insoluble form of Phosphorus such as rock Phosphate to soluble Phosphorus i.e phosphate(5).

Potassium Mobilisation:

Potassium is also a major nutrient required by plants. Soil Microorganisms principally Bacteria play a key role in Mobilizing the Potassium and thus making Potassium available to plants. Generally crops like Rice, Sugarcane, Potato require more Potassium. Actually only 2% of total Potassium in the soil is in the available form and remaining 98% of the soil Potassium is locked up in soil minerals and not available for plant absorption. In this respect Freteuria aurantia Bacterial strain has been observed for growth promoting effects by Potassium mobilization(1).

Formation of Humus:

Soil Microorganisms decompose the Organic matter of the soil and left over or undegraded organic matter becomes humus(6). Humus is a dark brown amorphous, residual matter and jelly like substance. Humus plays an important role in:-

- Slow release of Nutrients into the soil.
- Improves the Water holding capacity of soil.
- Improves the soil structure.
- Improves the Cation exchange capacity of soil.

CONCLUSION:

Soil Microorganisms improve the nutrient status of the soil and thereby increasing the availability of nutrients to plants. This enhances the crop productivity. Therefore, the role of Microorganisms can be exploited in agriculture by reducing the inputs of chemical fertilizers. This reduces the soil pollution and improves soil health. Hence farmers should be encouraged to use Biofertilisers.

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